CLAIMS

1. A monocrystalline etch-stop layer system for use on a monocrystalline Si substrate, said system comprising a substantially relaxed graded layer of $Si_{1-x}Ge_x$, and a uniform etch-stop layer of substantially relaxed $Si_{1-y}Ge_y$.

2. The system of claim 1, wherein $x<0.20$.

3. The system of claim 1, wherein $y>0.19$.

4. The system of claim 1, wherein $x<0.20$ and $y>0.19$.

5. The system of claim 1, wherein said $Si_{1-y}Ge_y$ layer is bonded to a second substrate.

6. The system of claim 5, wherein said second substrate comprises Si.

7. The system of claim 5, wherein said second substrate comprises glass.

8. The system of claim 5, wherein said second substrate comprises quartz.

9. The system of claim 5, wherein said second substrate comprises a layer of SiO_2 on a

second Si substrate.

10. The system of claim 5, wherein the first Si substrate and graded layer are substantially removed.

11. The system of claim 6, wherein the first Si substrate and graded layer are substantially removed.

12. The system of claim 7, wherein the first Si substrate and graded layer are substantially removed.

13. The system of claim 8, wherein the first Si substrate and graded layer are substantially removed.

14. The system of claim 9, wherein the first Si substrate and graded layer are substantially removed.

15. The system of claim 1, wherein a SiO_2 layer is deposited onto said $Si_{1-y}Ge_y$ layer.

16. The system of claim 15, wherein said SiO_2 layer is bonded to a second substrate.

17. The system of claim 16, wherein said second substrate comprises a layer of SiO_2 on a second Si substrate.

18. The system of claim 16, wherein said second substrate comprises a layer of SiO_2 on a glass substrate.

19. The system of claim 16, wherein said second substrate comprises a layer of SiO_2 on a quartz substrate.

20. The system of claim 16, wherein the first Si substrate and graded layer are substantially removed.

21. The system of claim 17, wherein the first Si substrate and graded layer are substantially removed.

22. The system of claim 18, wherein the first Si substrate and graded layer are substantially removed.

23. The system of claim 19, wherein the first Si substrate and graded layer are substantially removed.

24. The system of claim 10, wherein the surface is planarized.

25. The system of claim 11, wherein the surface is planarized.

26. The system of claim 12, wherein the surface is planarized.

27. The system of claim 13, wherein the surface is planarized.

28. The system of claim 14, wherein the surface is planarized.

29. The system of claim 20, wherein the surface is planarized.

30. The system of claim 21, wherein the surface is planarized.

31. The system of claim 22, wherein the surface is planarized.

32. The system of claim 23, wherein the surface is planarized.

33. A monocrystalline etch-stop layer system for use on a monocrystalline Si substrate, said system comprising a substantially relaxed graded layer of $Si_{1-x}Ge_x$; a uniform etch-stop layer of substantially relaxed $Si_{1-y}Ge_y$; and a strained $Si_{1-z}Ge_z$ layer.

34. The system of claim 33, wherein $z<y$.

35. The system of claim 33, wherein $y>0.18$.

1 36. The system of claim 33, wherein $y>0.18$ and $z<y$.

1 37. The system of claim 33, wherein $y>0.18$ and $z=0$.

1 38. The system of claim 33, wherein said $Si_{1-z}Ge_z$ is bonded to a second substrate.

1 39. The system of claim 38, wherein said second substrate comprises Si.

1 40. The system of claim 38, wherein said second substrate comprises glass.

1 41. The system of claim 38, wherein said second substrate comprises quartz.

1 42. The system of claim 38, wherein said second substrate comprises a layer of SiO_2 on a
2 second Si substrate.

1 43. The system of claim 38, wherein the first Si substrate and graded layer are
2 substantially removed.

1 44. The system of claim 39, wherein the first Si substrate and graded layer are
2 substantially removed.

1 45. The system of claim 40, wherein the first Si substrate and graded layer are

substantially removed.

46. The system of claim 41, wherein the first Si substrate and graded layer are substantially removed.

47. The system of claim 42, wherein the first Si substrate and graded layer are substantially removed.

48. The structure in claim 33 in which a SiO_2 layer is deposited onto said $Si_{1-z}Ge_z$ layer.

49. The system of claim 48, wherein said SiO_2 layer is bonded to a second substrate.

50. The system of claim 49, wherein the second substrate comprises a layer of SiO_2 on a second Si substrate.

51. The system of claim 49, wherein the second substrate comprises a layer of SiO_2 on a glass substrate.

52. The system of claim 49, wherein the second substrate comprises a layer of SiO_2 on a quartz substrate.

53. The system of claim 49, wherein the first Si substrate and graded layer are substantially removed.

54. The system of claim 50, wherein the first Si substrate and graded layer are substantially removed.

55. The system of claim 51, wherein the first Si substrate and graded layer are substantially removed.

56. The system of claim 52, wherein the first Si substrate and graded layer are substantially removed.

57. A monocrystalline etch-stop layer system for use on a monocrystalline Si substrate, comprising a substantially relaxed graded layer of $Si_{1-x}Ge_x$; a uniform etch-stop layer of substantially relaxed $Si_{1-y}Ge_y$; a second etch-stop layer of strained $Si_{1-z}Ge_z$; and a substantially relaxed $Si_{1-w}Ge_w$ layer.

58. The system of claim 57, wherein $y-0.05<w<y+0.05$.

59. The system of claim 57, wherein $w=y$.

60. The system of claim 57, wherein said $Si_{1-w}Ge_w$ is bonded to a second substrate.

61. The system of claim 60, wherein said second substrate comprises Si.

62. The system of claim 60, wherein said second substrate comprises glass.

63. The system of claim 60, wherein said second substrate comprises quartz.

64. The system of claim 60, wherein said second substrate comprises a layer of SiO_2 on a second Si substrate.

65. The system of claim 60, wherein the first Si substrate and graded layer are substantially removed.

66. The system of claim 61, wherein the first Si substrate and graded layer are substantially removed.

67. The system of claim 62, wherein the first Si substrate and graded layer are substantially removed.

68. The system of claim 63, wherein the first Si substrate and graded layer are substantially removed.

69. The system of claim 64, wherein the first Si substrate and graded layer are substantially removed.

70. The system of claim 57, wherein a SiO_2 layer is deposited onto said $Si_{1-w}Ge_w$ layer.

71. The system of claim 70, wherein said SiO_2 layer is bonded to a second substrate.

72. The system of claim 70, wherein the second substrate comprises a layer of SiO_2 on a second Si substrate.

73. The system of claim 70, wherein the second substrate comprises a layer of SiO_2 on a glass substrate.

74. The system of claim 70, wherein the second substrate comprises a layer of SiO_2 on a quartz substrate.

75. The system of claim 70, wherein the first Si substrate and graded layer are substantially removed.

76. The system of claim 71, wherein the first Si substrate and graded layer are substantially removed.

77. The system of claim 72, wherein the first Si substrate and graded layer are substantially removed.

78. The system of claim 73, wherein the first Si substrate and graded layer are

substantially removed.

79. The system of claim 74, wherein the first Si substrate and graded layer are substantially removed.

80. A method of integrating a device or layer comprising:

depositing a substantially relaxed graded layer of $Si_{1-x}Ge_x$ on a Si substrate;

depositing a uniform etch-stop layer of substantially relaxed $Si_{1-y}Ge_y$ on said graded buffer; and

etching portions of said substrate and said graded buffer in order to release said etch-stop layer.

81. The method of claim 80, wherein $x<0.20$.

82. The method of claim 80, wherein $y>0.19$.

83. The method of claim 80, wherein $x<0.20$ and $y>0.19$.

84. The method of claim 80, wherein the etchant used to release the etch-stop layer is KOH.

85. The method of claim 80, wherein the etchant used to release the etch-stop layer is TMAH.

86. The method of claim 80, wherein the etchant used to release the etch-stop layer is EDP.

87. The method of claim 80, wherein the etch-stop is released and the etch-stop layer is planarized.

88. The method of claim 87, wherein the method of planarization is chemical-mechanical polishing (CMP).

89. A method of integrating a device or layer comprising:

depositing a substantially relaxed graded layer of $Si_{1-x}Ge_x$ on a Si substrate;

depositing a uniform first etch-stop layer of substantially relaxed $Si_{1-y}Ge_y$ on said graded buffer;

depositing a second etch-stop layer of strained $Si_{1-z}Ge_z$;

depositing a substantially relaxed $Si_{1-w}Ge_w$ layer;

etching portions of said substrate and said graded buffer in order to release said first etch-stop layer; and

etching portions of said residual graded buffer in order to release the second etch-stop $Si_{1-z}Ge_z$ layer.

90. The method of claim 89, wherein the etchant used to release the second etch-stop layer comprises an oxidant and an oxide stripping agent.

91. The method of claim 90, wherein the oxidant oxidizes Ge much more rapidly than Si.

92. The method of claim 90, wherein the oxidant comprises H_2O_2.

93. The method of claim 90, wherein the stripping agent comprises HF.

94. The method of claim 90, wherein the oxidant comprises H_2O_2 and the stripping agent comprises HF.

95. The method of claim 94, wherein the diluting agent comprises CH_3COOH.

96. The method of claim 95, wherein the ratio of chemicals in the etchant are (1:2:3) for (HF: H_2O_2: CH_3COOH).

97. The method of claim 89, wherein wet oxidation is used to selectively oxidize the $Si_{1-x}Ge_x$ and $Si_{1-y}Ge_y$, thereby acting as an etch-stop with respect to $Si_{1-z}Ge_z$.

98. The method of claim 97, wherein the wet oxidation temperature is <750 degrees Celsius.

99. The method of claim 97, wherein the oxidized layers are removed by an HF and

water solution.

100. The method of claim 98, wherein the oxidized layers are removed by an HF solution.

101. The method of claim 90, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

102. The method of claim 91, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

103. The method of claim 92, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

104. The method of claim 93, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

105. The method of claim 94, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

106. The method of claim 95, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

1 107. The method of claim 96, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using
2 a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

1 108. The method of claim 97, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using
2 a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

1 109. The method of claim 98, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using
2 a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

1 110. The method of claim 99, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using
2 a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.

1 111. The method of claim 100, wherein the $Si_{1-z}Ge_z$ layer is subsequently removed using
2 a selective etchant with respect to the $Si_{1-w}Ge_w$ layer.